

General Certificate of Secondary Education

B234

Manufacturing

Design for Manufacture and Sustainability

Specimen Paper

Time: 1 hour

Candidates answer on the question paper.

Additional materials:

Candidate
Forename

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Candidate
Surname

--	--	--	--	--	--

Centre
Number

--	--	--	--	--	--

Candidate
Number

--	--	--	--	--	--

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each answer carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do not write in the bar codes.
- Do not write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is 60.

For Examiner's Use Only	
1	
2	
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11	
12	
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14	
15	
16	

This document consists of **11** printed pages and **1** blank pages.

[Turn over

Answer **all** questions.

- 1 For each products listed below select the correct sector they are manufactured in.

SECTORS

Chemical and Pharmaceutical:
Clothing and Textiles
Electrical and IT
Food and Drink
Furniture
Machinery and Equipment
Packaging

Product:

Gluten free ready meal.....

Lipstick.....

Outdoor sportswear.....

Touch screen.....

Pressure washer.....

Sandwich carton.....

Child's cot.....

[7]

2 Tick **one** product:

- ☐ Gluten free ready meal
- ☐ Lipstick
- ☐ Outdoor sportswear
- ☐ Touch screen
- ☐ Pressure washer
- ☐ Sandwich carton
- ☐ Child's cot

For your chosen product state one **technology** used:

Technology.....[1]

For your chosen product state one **benefit** of using that technology:

Benefit.....[1]

3 Name **one** specific tool or item of equipment you have used to manufacture a product and describe how to use it safely.

Tools/equipment.....[1]

Safe use.....

.....

.....[2]

- 4 Describe **two** features of a product you have studied that show it has been designed for manufacturing assembly.

Name of product:

1

.....

..... [2]

2

.....

..... [2]

- 5 Connect **one** manufacturing sector to a standardised component used in that sector.

SECTOR

chemical and pharmaceutical
clothing and textiles
electrical and IT
food and drink
furniture
packaging
machinery and equipment

COMPONENT

zip fasteners
castors
nuts and bolts
child resistant containers
polystyrene beads
LEDs
Chocolate vermicelli

[1]

- 6 Choose a **different** manufacturing sector and connect it to a standardised component used in that sector.

SECTOR

chemical and pharmaceutical
clothing and textiles
electrical and IT
food and drink
furniture
packaging
machinery and equipment

COMPONENT

zip fasteners
castors
nuts and bolts
child resistant containers
polystyrene beads
LEDs
Chocolate vermicelli

[1]

7 Give **two** factors to consider when deciding whether to use standardised components

Factor 1
..... [2]

Factor 2
..... [2]

8 Tick the **two** most important issues to consider when deciding whether to buy in pre-processed materials rather than to process them on site.

- ☐ Marketing
- ☐ Packaging costs
- ☐ Space requirements
- ☐ Machinery costs
- ☐ Material properties
- ☐ Assembly methods
- ☐ Quality

[2]

[Turn over

9 One consideration in Design for Manufacturing Assembly (DFMA) is **handling**

Tick **two** issues when considering handling.

- ☐ Marketing
- ☐ Packaging costs
- ☐ Space requirements
- ☐ Material properties
- ☐ Assembly methods
- ☐ Quality

[2]

10 Describe a different consideration for each area below when designing for lean manufacture.

materials

.....

..... [2]

manufacturing processes

.....

..... [2]

quality control

.....

..... [2]

11 (a) Tick **two** items that are scrap.

- ☐ Contaminated materials
- ☐ Spare materials for recycling
- ☐ Offcuts that could be reused
- ☐ Faulty products that cannot be reworked or sold on
- ☐ Spare components

[2]

(b) Describe in detail how **one** specific type of scrap can be generated during the manufacturing process.

.....

.....

.....

[2]

12 (a) Tick **two** strategies for reducing production costs without changing the product specification.

- ☐ Lay off some operators
- ☐ Find a cheaper source of materials
- ☐ Automate production
- ☐ Modify cutting plans
- ☐ Increase production

[2]

[Turn over

(b) Explain how Just in Time (JIT) stocking reduces overproduction

.....

.....

.....

..... [4]

13 Following a new product launch, orders have doubled.

























Describe how **three** areas of the production plan would need to be modified.

1..... [2]

2..... [2]

3..... [2]

14 Part of a flow process chart is shown.

Flow Process Chart			
<input checked="" type="checkbox"/> Present method <input type="checkbox"/> Proposed method			
Subject: Finishing and packaging			
Chart begins: Air cooling			
Chart ends: Pack in outer cartons			
Symbols	Description	Distance (m)	Time (s)
 ⇒ <input type="checkbox"/>  ▽	Air cooling		
 ⇒ <input type="checkbox"/>  ▽	Remove from mould		
 ⇒ <input type="checkbox"/>  ▽	Conveyor to line 2		
 ⇒ <input type="checkbox"/>  ▽	Trim edges		
 ⇒ <input type="checkbox"/>  ▽	Conveyor to inspection		
 ⇒ <input type="checkbox"/>  ▽	Manual inspection		
 ⇒ <input type="checkbox"/>  ▽	Pierce top		
 ⇒ <input type="checkbox"/>  ▽	Wait		
 ⇒ <input type="checkbox"/>  ▽	Carry to packing line		
 ⇒ <input type="checkbox"/>  ▽	Box in dozens		
 ⇒ <input type="checkbox"/>  ▽	Conveyor to line 4		
 ⇒ <input type="checkbox"/>  ▽	Pack in outer cartons		

Tick the correct meaning of the two symbols below.

Symbol 1  ▽

- ☐ Operation
☐ Delay
☐ Transport
☐ Storage

[1]

Symbol 2  ⇒

- ☐ Delay
☐ Transport
☐ Storage
☐ Inspection

[1]

15 Explain the contribution of flow process charts to lean manufacture.

.....

.....

.....

..... [4]

16 Please note that the instruction 'discuss' means that you should:

- identify **three** relevant issues/points raised by the question;
- explain why you consider **two** of these issues to be relevant;
- use **one** specific example or piece of evidence to support your answer.

Discuss the impact of Design for Manufacturing Assembly (DFMA) on manufactured products.

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

Total Marks: [60]

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SPECIMEN

[BLANK PAGE]

SPECIMEN

The maximum mark for this paper is 60.

SPECIMEN

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[7]

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3	<p>Name <u>one</u> specific tool or item of equipment you have used to manufacture a product and describe how to use it safely.</p> <p>One mark for giving the correct name of a tool or item of equipment Eg vegetable (or other specific named) knife, scissors, chisel, vacuum former</p> <p>two marks for safe use described: eg wear protective clothing (1), such as (1). Use a chopping board(1) to avoid blade slipping (1) beware of hot/sharp items(1).</p>	[3]
4	<p>Describe <u>two</u> features of a product you have studied that show it has been designed for manufacturing assembly.</p> <p>No marks for naming product</p> <p>2 marks for first feature described 2 marks for second feature described</p> <p>Eg lugs(1) for lifting in assembly(1), dog-nosed bolts(1) for auto insertion(1), yogurt packaging(1) with date stamp(1) space, injection mould evidence(1) (from sprues(1) or date/moulding number marks(1))</p>	[4]











































































Question Number	Answer	Max Mark																												
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Furniture	Castors															
Packaging	Polystyrene beads															
Machinery and Equipment	Nuts and bolts															
7	<p>Give <u>two</u> factors to consider when deciding whether to use standardised components</p> <p>Labels, buttons, resistors, transistors, wood screws, foil trays, washers...</p> <p>2 marks for each appropriate factor given eg:</p> <p>Availability as(1) and when(1) required for production.</p> <p>Use in products already made(1) onsite(1)</p> <p>Cost(1) compared with making in house(1)</p> <p>Performance(1) compared with specialised component/other methods(1)</p> <p>One mark only for factor not expanded, eg availability, cost.</p>	[4]														
8	<p>Tick the <u>two</u> most important issues to consider when deciding whether to buy in pre-processed materials rather than to process them on site.</p> <p><input type="checkbox"/> Marketing</p> <p><input type="checkbox"/> Packaging costs</p> <p><input checked="" type="checkbox"/> Space requirements</p> <p><input type="checkbox"/> Machinery costs</p> <p><input type="checkbox"/> Material properties</p> <p><input type="checkbox"/> Assembly methods</p> <p><input type="checkbox"/> Quality</p> <p>One mark for each of 2 from:</p> <p>Space requirements</p> <p>Machinery costs</p> <p>Quality</p>	[2]														

Question Number	Answer	Max Mark
9	<p>One consideration in Design for Manufacturing Assembly (DFMA) is handling</p> <p>Tick <u>two</u> issues when considering handling.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Marketing <input type="checkbox"/> Packaging costs <input type="checkbox"/> Space requirements <input type="checkbox"/> Material properties <input type="checkbox"/> Assembly methods <input type="checkbox"/> Quality <p>One mark for each of 2 from: Machinery costs Material properties Assembly methods Space</p>	[2]
10	<p>Describe a different consideration for each area below when designing for lean manufacture.</p> <p>Materials</p> <p>Manufacturing processes</p> <p>Quality control</p> <p>2 marks for clear description of a consideration related to each area (one for a single point):</p> <p><u>Materials</u> processing requirements (1) physical properties (1) to suit product specification(1) cost(1) availability(1) form supplied(1)</p> <p><u>Manufacturing processes</u> Processing times(1) Reliability/efficiency(1)make to meet spec(1)cost of equipment(1)</p> <p><u>Quality control</u> Inspection points(1)Improvement in reject rate(1)cost(1) of automatic equipment(1)/staffing.</p>	[6]

Question Number	Answer	Max Mark
11(a)	<p>Tick <u>two</u> items that are scrap.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Contaminated materials <input type="checkbox"/> Spare materials for recycling <input type="checkbox"/> Offcuts that could be reused <input type="checkbox"/> Faulty products that cannot be reworked or sold on <input type="checkbox"/> Spare components <p>One mark each for spare materials for recycling and offcuts that could be re-used</p>	[2]
11(b)	<p>Describe in detail how <u>one</u> specific type of scrap can be generated during the manufacturing process.</p> <p>Chemical and Pharmaceutical</p> <ul style="list-style-type: none"> - lipstick misshapes reformed - powder from tabletting (can be re-pressed) <p>Clothing and textiles</p> <ul style="list-style-type: none"> - small offcuts /materials at end of runs (sold on) <p>Electrical and IT</p> <ul style="list-style-type: none"> - faulty pcbs (sent for stripping) <p>Food and drink</p> <ul style="list-style-type: none"> - outer leaves from trimmed vegetables <p>Furniture</p> <ul style="list-style-type: none"> - wood/metal offcuts <p>Machinery and Equipment</p> <ul style="list-style-type: none"> - over ordered components <p>Packaging</p> <ul style="list-style-type: none"> - offcuts from platens 	[2]

Question Number	Answer	Max Mark
12(a)	<p>Tick <u>two</u> strategies for reducing production costs without changing the product specification.</p> <p><input type="checkbox"/> Lay off some operators</p> <p><input type="checkbox"/> Find a cheaper source of materials</p> <p><input type="checkbox"/> Automate production</p> <p><input type="checkbox"/> Modify cutting plans</p> <p><input type="checkbox"/> Increase production</p> <p>One mark for Find a cheaper source of materials</p> <p>One mark for Modify cutting plans</p>	[2]
12(b)	<p>Explain how Just in Time (JIT) stocking reduces overproduction</p> <p>Four marks for detailed explanation. (1 for each point below to 4)</p> <p>Products are scheduled to meet orders received (1) be finished when dispatch is due (1). Materials and components are delivered to workstations (1) as needed for production (1) this means there is no waiting time (1) and stocks of finished product are not needed to meet orders (1), so no extras are made (1).</p>	
13	<p>Following a new product launch, orders have doubled. Describe how <u>three</u> areas of the production plan would need to be modified.</p> <p>One mark for a production plan area identified and additional 1 for a change related to doubling production.</p> <p>Materials (1) need double quantities (1)</p> <p>Workers or workstations (1) increased (1)</p> <p>Tools/equipment (1) need extra machines to process more (1)/tools for workers</p> <p>Linespeed or rate (1) doubled (1) or additional line (1)</p> <p>Storage (1) for extra materials (1) stock ready to dispatch (1)</p>	[6]

Question Number	Answer	Max Mark																																																				
14	<p>Part of a flow process chart is shown.</p> <div><div><div><div>Flow Process Chart</div><div><input checked="" type="checkbox"/> Present method <input type="checkbox"/> Proposed method</div><div>Subject: Finishing and packaging</div><div>Chart begins: Air cooling</div><div>Chart ends: Pack in outer cartons</div></div><table><thead><tr><th>Symbols</th><th>Description</th><th>Distance (m)</th><th>Time (s)</th></tr></thead><tbody><tr><td> ⇒ </td><td>Air cooling</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Remove from mould</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Conveyor to line 2</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Trim edges</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Conveyor to inspection</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Manual inspection</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Pierce top</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Wait</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Carry to packing line</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Box in dozens</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Conveyor to line 4</td><td></td><td></td></tr><tr><td> ⇒ </td><td>Pack in outer cartons</td><td></td><td></td></tr></tbody></table><p>Tick the correct meaning of the <u>two</u> symbols below.</p><p>Symbol 1 </p><p><input type="checkbox"/> Operation</p><p><input type="checkbox"/> Delay</p><p><input type="checkbox"/> Transport</p><p><input type="checkbox"/> Storage</p><p>Symbol 2 </p><p><input type="checkbox"/> Delay</p><p><input type="checkbox"/> Transport</p><p><input type="checkbox"/> Storage</p><p><input type="checkbox"/> Inspection</p><p>One mark for delay</p><p>One mark for transport</p></div></div>	Symbols	Description	Distance (m)	Time (s)	 ⇒ 	Air cooling			 ⇒ 	Remove from mould			 ⇒ 	Conveyor to line 2			 ⇒ 	Trim edges			 ⇒ 	Conveyor to inspection			 ⇒ 	Manual inspection			 ⇒ 	Pierce top			 ⇒ 	Wait			 ⇒ 	Carry to packing line			 ⇒ 	Box in dozens			 ⇒ 	Conveyor to line 4			 ⇒ 	Pack in outer cartons			
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Question Number	Answer	Max Mark
15	<p>Explain the contribution of flow process charts to lean manufacture.</p> <p>Four marks for detailed explanation:</p> <p>Flow process charts are used when analyzing the steps in a process, to help identify and eliminate waste. They show each step of a process in order (1) graphically(1), making it easier to see where time is being wasted(1)/identify idle time(1).</p>	[4]
16	<p>Please note that the instruction ‘discuss’ means that you should:</p> <ul style="list-style-type: none"> • identify <u>three</u> relevant issues/points raised by the question; • explain why you consider <u>two</u> of these issues to be relevant; • use <u>one</u> specific example or piece of evidence to support your answer. <p>Discuss the impact of Design for Manufacturing Assembly (DFMA) on manufactured products.</p> <p>Discuss the impact of Design for Manufacturing Assembly (DFMA) on manufactured products.</p> <p>Six marks for a discussion giving 3 relevant points, stating why 2 are relevant and giving an example. Or</p> <p>For critical evaluation of the impact (showing understanding of DFMA). For example:</p> <p>Common fixing strategy(1) enables equipment reuse(1).</p> <p>Standardised components (1) reduces inventory(1)</p> <p>Complexity reduction (1) to facilitate automation (1)</p> <p>Make versus buy (1)</p> <p>Handling (1)</p> <p>Product prices may be reduced due to overall production cost savings(1)</p> <p>products may be shaped differently (1) eg draft angles(1)</p> <p>Less variety between products (1) form follows production(1)</p>	[6]
Paper Total		[60]

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1	7			7
2	2			2
3		3		3
4	4			4
5	1			1
6	1			1
7	4			4
8	2			2
9		2		2
10	2	4		6
11	2	2		4
12		2	4	6
13		6		6
14		2		2
15			4	4
16			6	6
Totals	25	21	14	60